"the packet"

The newsletter of V.A.D.C.G.

The Vancouver Amateur Digital Communications Group

Issue 4 March 1981

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In This Issue

We are pleased to report two new packet radio operations.

The KA6M/R Packet Repeater operates as a beacon and as a repeater in the San Francisco area.

Hank Magnuski, KA6M, has put out a detailed information sheet, on his system, which we have reprinted in its entirety.

Since the operation of the VADCG beacon/repeater is virtually identical to KA6M's, his explanation will also cover our system.

In Ontario, the Hamilton and Area Packet Network has been formed. They also use the VADCG Terminal Node Controller, so the three systems we know of are compatible.

The H.A.P.N. has put out two bulletins so far, with lots of good information. We have lifted some of their articles which we feel will have wide appeal and have included them in this newsletter. The articles are:

Additional LED indicators on the VADCG board.

TNC Trap modification and LED Mod.

Generation of "DCD"

SDLC And Bit Oriented Protocols.

For more information on HAPN, the address is:
2391 Arnold Crescent,
Burlington, Ontario L7P 4J2

In "That's Progress", John, VE7ADE, reports on the Vancouver area.

Bob, VE7CYB, explains the 1200 baud modem card currently being tested and improved.

"Proposed Design of a High-Speed, Low Cost 220 MHz FSK Transceiver for Amateur Digital Communications" is a copy of a letter from Doug, VE7APU, to John Stenbakken in San Pedro, CA.

VADCG Goes Formal

In the past, the VADCG has been an informal organization, relying on donations and irregular meetings of a small working group. On Dec. 9, 1981 a meeting, attended by seventeen people, was held to discuss the future structure of the group. The decisions of that meeting were:

Regular meetings, open to all interested members, will be held; probably every three months.

Dues for 1981 (local members) to be $15.00, including newsletter.

Newsletter only will be $10.00.

Meeting chairman will be John Spraggs, VE7ADE. Secretary-treasurer will be Don Oliver, VE7AOG.

Wanted: Your Input

For Sale, Trade, Wanted, etc. ads will be printed in "the packet" as a free service.

We also invite your comments, news, etc.

That's Progress

The 145.65 MHz VE7PKT beacon now has echo capability. A valid packet will be re-transmitted to permit testing of user's Terminal Node Controllers until the Station Node is up and running on a permanent basis.

First to use this feature was Bob, VE7CYB. His box of tricks also includes a 103 type auto-answer type modem which can be used as a gateway between the network and a telephone link. John, VE7ADE, used his Apple and another of Bob's modems to access VE7PKT through the gateway.

Richard, VE7CVS, has since tested his terminal equipment with the beacon and expects to use the terminal-to-terminal software to talk to Bob and others until the Station Node is ready.

The 1200 baud modem card being taped by Brian McIntosh will allow most of the current holders of completed controller boards in the Vancouver area to finish the hardware construction of their systems in time for the turn-up of the Station Node.

The wirewrap version of the Z80-compatible S100 HDLC board to be used in the Station Node is almost completely checked out and should be on the air shortly after Doug gets back from Connecticut. That will also be the time when taping of a printed-circuit version will begin for use in station nodes in other cities. □

General Meeting

The next meeting of the VADCG will be held on Thursday, March 19, at 8:00 PM.

LOCATION: The church basement at 336 Agnes St. in New Westminster. Note that the entrance is on the East side of the building, not on Agnes St.

All are welcome; members and non-members. □

1200 Baud Modem

The group has been developing an inexpensive type 202 audio shift modem for use on the packet radio network. The circuit card design is now in the third version. We plan to make it available soon.

Failure of the first version was due to the selection of the XR-210 integrated circuit. This was found to be a poor choice for the type 202 modem with its wide shift to center frequency ratio. This same chip, however, may be superior for narrow shift modems, such as type 103, or RTTY, since it has a fast capture on a small angular change of a single cycle of audio.

When a revision of the board was required to use the XR-2211 and XR-2206 chip pair, Don, VE7AOG, prepared new artwork and etched the first prototype cards. This version worked very well! The "data eye" was very clean and may very well out-perform some commercial units. Included in this version were some new features, that are very desirable in a radio modem, as follows:

1. Transmit timeout
2. Request to send - clear to send delay
3. Single or split power supply
4. Microphone or data multiplexing to the audio output
5. RS-232 output
6. Data carrier detect
7. LED status indicators
8. Self-test audio loopback

.... Continued on page 7

PROPOSED DESIGN OF A HIGH-SPEED, LOW COST 220MHZ FSK TRANSCEIVER FOR AMATEUR DIGITAL COMMUNICATIONS

by Doug Lockhart, VE7APU

Enclosed is a package of information we have assembled which will give you a better idea of what we think is needed to provide a high-speed digital communications transceiver. Most of the circuit details have been taken from various amateur publications. John Spraggs, VE7ADE and myself have worked on getting this information together in this form. The information is only intended to give you ideas and is definitely not in a final design state. It should be noted that this transceiver circuit is much simpler than the average commercial amateur transceiver and yet may be able to transmit and receive digital signals of up to 100KBd.

Rough specifications of the transceiver follow:

1. Fast transmit-receive switching. The objective is to get a T/R switch in less than one millisecond. At high data rates, the T/R switching time becomes the limiting factor in data throughput. The T/R circuitry shown in the enclosed information should meet this requirement.
2. RS-232 input and output levels. This is to interface with our programmable communications controller board and this is the industry standard interface.
3. Wide bandwidth so that it is capable of transmitting data and receiving data up to about 100KBaud. This is very important as it is the main stumbling block when trying to use any of the current ham equipment for digital communications. The bandwidth should be about 100KHz. wide at the 3 db points. This of course will be optimized for high speeds but should also work with narrower bandwidth signals at slightly less than optimum performance. It also has the advantage of not requiring tight frequency stability specifications for the receiver and transmitter. Note that the bandwidth and IF frequency chosen are very similar to those of the FM broadcast band and, in fact, tests of an actual FM tuner IF strip passed digital signals at 140KBaud. The test was performed by John and the observed ´eye´ patterns were open at this data rate. This part of the circuit could be copied off existing FM broadcast receiver designs, including actual filters and IF-detector ICs (e.g. CA3089E).
4. 10.7 MHz. IF. This is a very common and readily available IF and so should be fairly inexpensive. This IF gives the required bandwidth and is sufficiently high so that only single conversion would be required.
5. Power level requirements are modest. Probably about one watt should be adequate because most of the usage will be effectively point to point. The only requirement is to reach the communications network with enough signal strength to provide reliable data communications. A higher than necessary signal to noise ratio will not be of any use.
6. It should be fairly inexpensive and use readily available parts. The intermod requirements need not be stringent and the

image rejection requirements need only be average. A front end filter should fix intermod and image problems where they are objectionable.

7. Low pass filtering should probably be provided on the input of the transmitter to limit splatter and increase the data rate possible on the channel. A simple RC filter should suffice. Too much filtering will cause intersymbol interference.

8. Carrier detect. This should be fast acting and is required because the protocol has a requirement to know when the channel is in use in order to prevent collisions and result in a higher throughput through the channel. The CA3089E has two outputs for obtaining this information. One is the squelch output line and the other is called the tuning meter output. It is not readily apparent which of these outputs would provide the better signal for rapid detection of the presence of a signal on the channel. There is room for experimentation here.

The formula for figuring out the transmission delay through a chain of store and forward digital repeaters is:

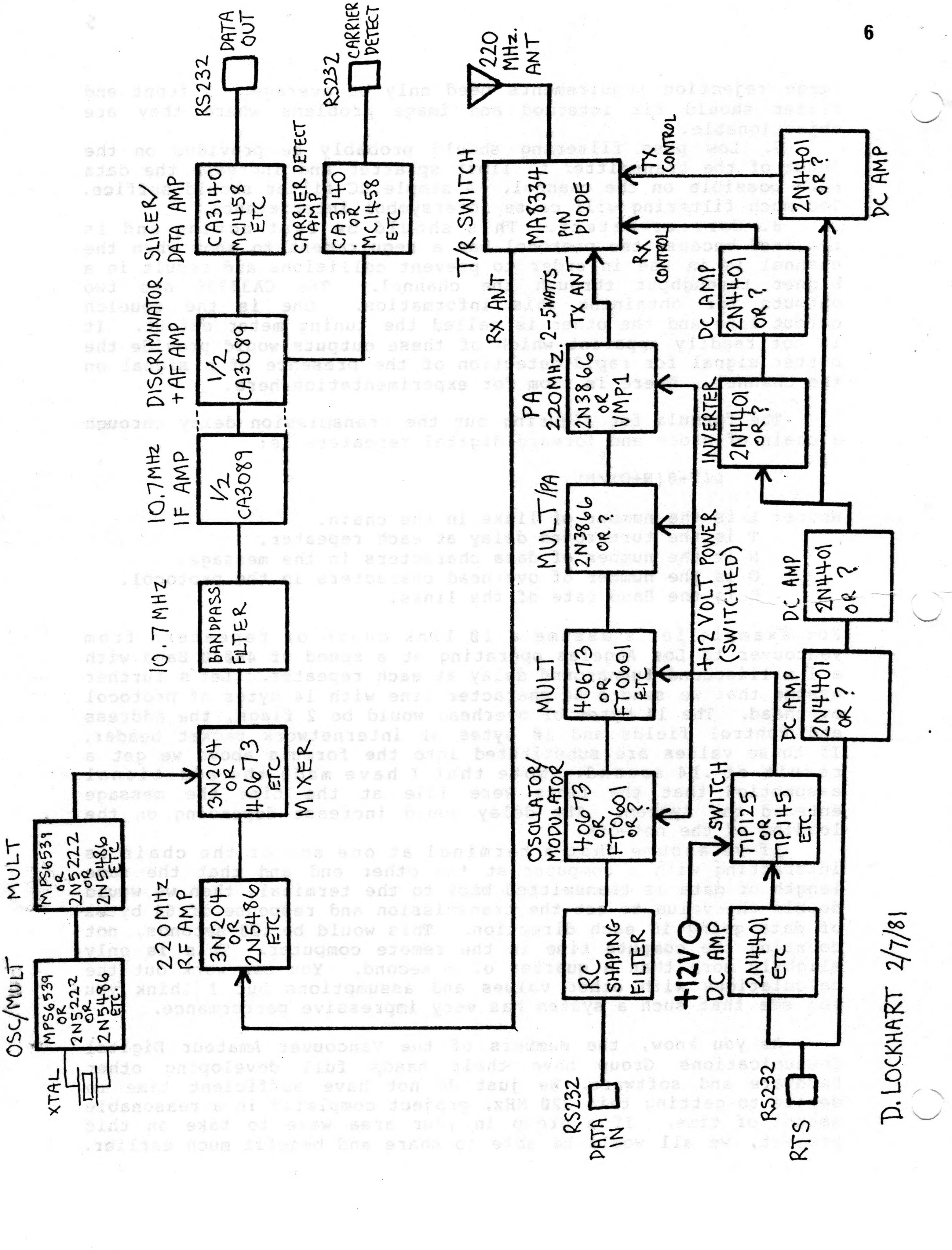
$$L(T+8(N+O)/B)$$

Where: L is the number of links in the chain.
T is the turnaround delay at each repeater.
N is the number of data characters in the message.
O is the number of overhead characters in the protocol.
B is the Baud rate of the links.

For example let's assume a 10 link chain of repeaters from Vancouver to Los Angeles operating at a speed of 48000 Baud with a 1 millisecond turnaround delay at each repeater. Let's further assume that we send a 64 character line with 14 bytes of protocol overhead. The 14 bytes of overhead would be 2 flags, the address and control fields and 10 bytes of internetwork packet header. If these values are substituted into the formula above we get a result of .14 second. Note that I have made the additional assumption that the links were idle at the time the message entered the system. The delay would increase depending on the loading of the network.

If we assume that a terminal at one end of the chain is interacting with a computer at the other end and that the same length of data is transmitted back to the terminal, then we would double the value to get the transmission and response of 64 bytes of data going in each direction. This would be .28 seconds, not counting the compute time in the remote computer. This is only slightly more than a quarter of a second. You can work out the calculations with other values and assumptions but I think you can see that such a system has very impressive performance.

As you know, the members of the Vancouver Amateur Digital Communications Group have their hands full developing other hardware and software. We just do not have sufficient time to devote to getting this 220 MHz. project completed in a reasonable amount of time. If a group in your area were to take on this project, we all would be able to share and benefit much earlier.



D. LOCKHART 2/7/81

Any assistance with the development of this transceiver would speed up the implementation of a continent-wide amateur communications network.

We need a transceiver such as this so we are not limited to the 1200 Baud limit imposed by the use of unmodified amateur transceivers designed for voice use. It may seem as though this design is not suitable for the present regulations in the U.S. which only authorize a maximum speed of 1200 Baud on the 220MHz. band. Here are a few reasons why I think it should be built:

1. The current regulations are expected to be changed to allow higher data rates in the near future.
2. Temporary authorization for higher data rates is easy to obtain at the present time. Successful use of such equipment under temporary authorization in the U.S. would have a desireable influence on future regulations.
3. The equipment can be used at lower data rates in any case. The transmitter deviation can be reduced to accommodate the lower data rate and the receiver can receive signals of lower deviation and rate even though the reception is not optimal. As explained above, most of the links will be basically point to point and will have good signal to noise ratio.
4. The equipment can be used immediately in Canada. Successful use of such equipment in Canada would surely have a favourable influence on future U.S. regulations.

I have quite a bit of documentation and design information to go along with the above general specifications and I would be pleased to send it to anyone who is seriously interested in doing the rest of the design and layout of a PC card. I am also available to discuss this project. I can make ´scheds´ on the 20 metre band (SSB) on most weekends and evenings. You can write to me at the following address:

1263 Balfour Avenue, Vancouver, B.C. V6H 1X6

73, Doug Lockhart VE7APU □

1200 Baud Modem ..from page 3

Although the card is functional, some changes are desirable. These are:

1. Add a stronger drive level to PTT
2. Add an adjustable attenuator to the signal output
3. Make the card a standard rack size
4. Make several connector types optional
5. Allow for prototype area for user.

These changes were not required to make it work, but rather to make it work better and under a wider range of conditions.

Since the modifications were too extensive to just patch the second version, Brian McIntosh volunteered to make the next revision. The changes have been documented and new artwork is under way.

Bob Livingston, VE7CYB □

***** KA6M/R PACKET REPEATER INFORMATION SHEET *****

The KA6M repeater is San Francisco's first, and possibly the nation's first, all digital simplex packet radio repeater for use in amateur radio. The repeater went into operation on December 10th, 1980 and since then has been running both as a packet repeater and a beacon. Here are some facts about the repeater and its operation:

- A packet radio repeater or digital repeater or "digipeater", as the Canadians call it, is a machine which receives a message or block of data, and after verification, retransmits that message on the same frequency channel where it was received. Thus, only a simplex channel is used, and the message transmitted is the same as the message received, except for the possible modification of some address or control bytes. The primary function of a packet repeater, as with a more conventional repeater, is to extend the geographic range and coverage of fixed or mobile stations.

- The KA6M/R repeater is currently operating on a simplex channel assigned for non-voice use, 146.580 MHz., and transmits data at a speed of 1200 Baud. The machine consists of a Z-80 microprocessor, a Bell 202 compatible modem, and a solid-state transceiver. The initial site is in Menlo Park, CA.

- The basic format of a packet or message block is an HDLC frame. The word HDLC stands for High-level Data Link Control which is a new and internationally recognized standard in the communications industry. A frame consists of an opening flag byte, an address byte, a control byte, an information field, two bytes of CRC checking, and a closing flag. The repeater uses NRZI (Non Return to Zero Inverting) encoding of the frame, which allows both clock and data to be recovered from one signal. The use of HDLC framing and control procedures guarantees highly reliable, nearly error free communications. The first use of HDLC framing by amateurs was done by members of the Vancouver Digital Communications Group, and we are following their lead.

- As a beacon the machine transmits three packets every 5 minutes, immediately following its CW id. Each packet contains approximately seventy ASCII characters. In functioning as a repeater, the machine will repeat any packet it receives which has the correct address and CRC checksum. The information field is currently limited to 256 bytes maximum.

- The control software for the repeater is written in PASCAL/Z, a PASCAL which generates native Z-80 code instructions. Assembly language interface routines have been written to control a Western Digital 1933 HDLC chip.

This repeater is just a first step in what will someday be a nationwide network of interconnected computer systems. Packet radio is a new frontier for amateur radio, a new medium unlike anything we are accustomed to today.

Please contact me if you are interested in more information about the repeater or wish to communicate with it.

Hank Magnuski, KA6M, 311 Stanford Ave., Menlo Park, CA 94025 * (415) 854-1927

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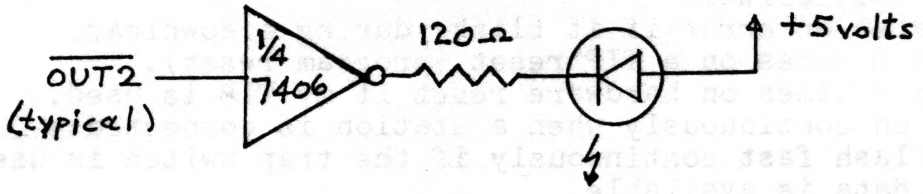
Additional LED indicators on the VADCG board

In case you are going to do some of your own software development for the VADCG board, here is the way I hooked up some LED indicators to give me some re-assurance that the software was operating and certain conditions were present (or absent).

There are 4 lines available for setting under program control. They are:

1) SOD on the 8085 processor (use RIM and SIM to alter)
2) -out2 on the 8250 UART (I/O to UART command register)
3) -PB3 on the 8273 (point F on the board)
4) -PB4 on 8273 (point G- for both use I/O to command reg.)

I connected these 4 locations to the inputs of 7406 open collector inverting drivers and pulled up the collector thru a 120 ohm resistor and a LED:



The only problem is that SOD has a positive true state while the others all are negative true. Thus the software SETs SOD to turn the LED off and CLEARs it to turn on. The other bits work correctly.

The code used to operate the LEDs is found in the Down Line Loader module, listed in the software section. The location referred to as CMDOUT is the same CMDOUT in the LIP: the routine used to setup the 8273.

Also included in the software section is a test routine which, when down loaded, flashes the 4 LEDs in 1,2,3,4,1,2,... sequence.

To re-cap: the LEDs are connected to SOD (pin 4) on the 8085, -OUT2 (pin 31) on the 8250, -PB3 (pin 38) and -PB4 (pin 39) on the 8273.

The code for operating the SOD LED should be modified to preserve the interrupt states by doing a RIM, the SOD masking and setting and then a SIM, rather than just a SIM. □

TNC Trap Modification and LED MOD

The TNC board here is slightly modified to use the trap function and a LED has been added to indicate status.

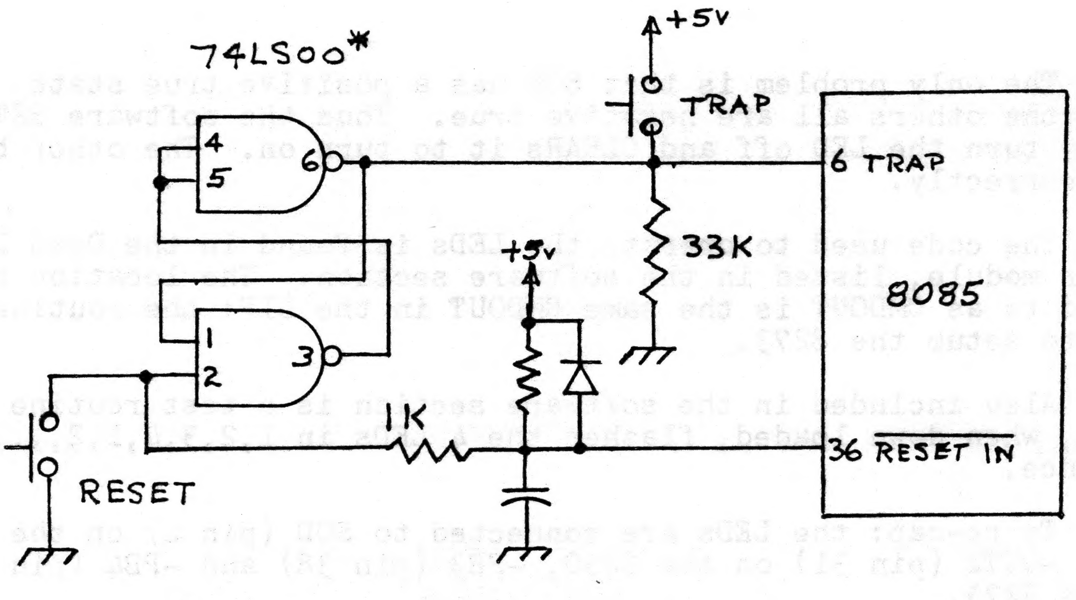
The existing trapswitch circuit creates bounce that makes saving the registers impossible. Also there is the land across R7 that has to be cut.

To eliminate the bounce problem I added an 7400LS to latch the trap status. The flipflop is reset by using the reset button. (see diagram 1) The IC is physically located on the board, below J4.

The LED is driven by a transistor from the SIO line of the 8085. (see diagram 2, from VE3EC) The LED and transistor are located here on the board at CR3 and D1, the resistors using the holes of R18 and CR2. Some traces had to be cut.

Some uses for the LED are:

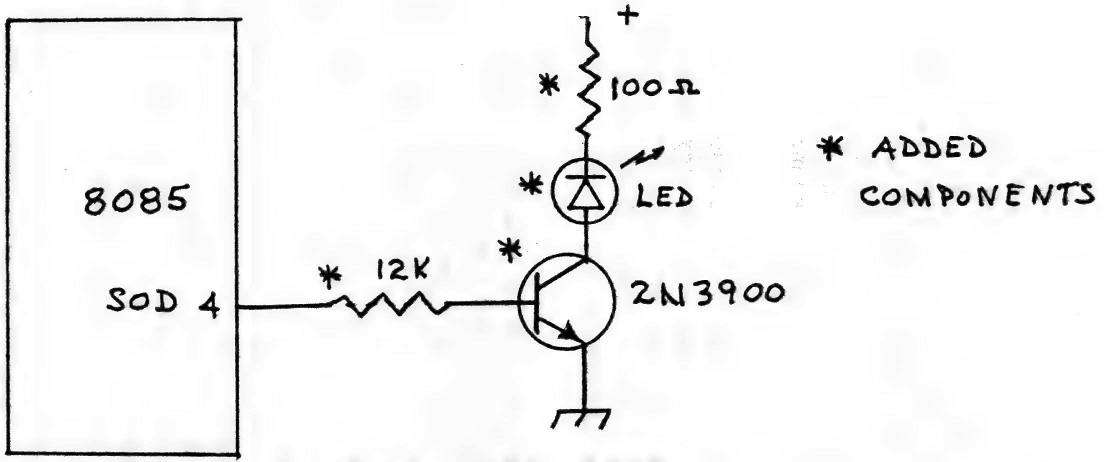
1. It blinks a couple of times on P.O.R. to indicate the LIP has been initialized.
2. It indicates an error if it blinks during a download.
3. It blinks 6 times on a TIP reset (program reset).
4. It blinks 6 times on hardware reset if my TIP is used.
5. It turns on continuously when a station is connected.
6. It will flash fast continuously if the trap switch is used and trap data is available.



*ADDED 74LS00 TO LATCH TRAP

1. TNC TRAP MODIFICATION

by J.C. VANDEN BERG VE3DVV



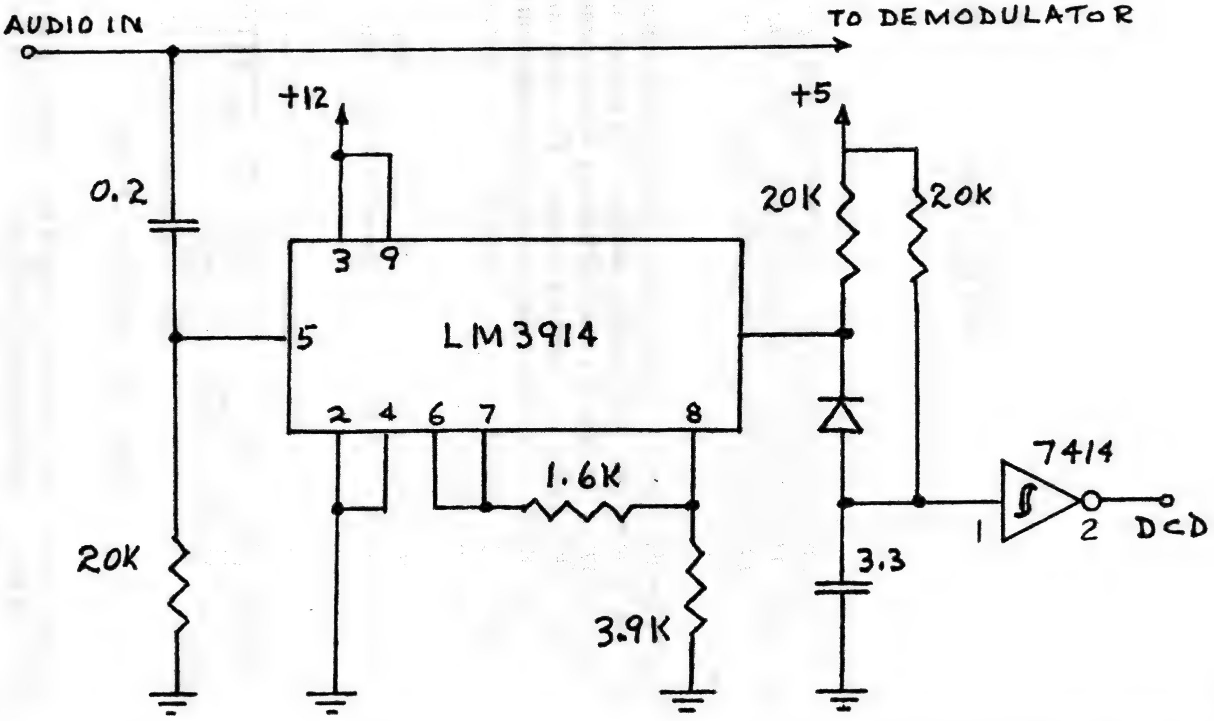
2. TNC LED MOD

by J.C. VANDEN BERG VE3DVV ☐

GENERATION of "DCD"

The following is a circuit used by Robert Sleath, VE3EFD, to generate "DCD" instead of digging into the guts of his handheld transceiver. It uses a National LM3914 Dot/Bar display driver (usually available from Radio Shack for less than $5.) The audio level is converted by the internal comparators into a series of LED driving levels.

The output from the lowest indicator is fed into a RC circuit to eliminate short transients and then thru a pair of schmidt triggers to provide switching hysteresis.



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CHAPTER 19
SDLC AND BIT ORIENTED PROTOCOLS

It is not the intent of this chapter to be a definitive source on SDLC, but rather to describe enough of its operation for the reader to get the general idea and to be able to more readily understand more detailed references on the subject.

First, a few definitions should be given. Any data communication link involves at least two participating stations. The station which has responsibility for the data link and which issues the commands to control that link is called the "primary station." The other station is a "secondary station." It is not necessary that all information transfers be initiated by a primary station. Using SDLC procedures, a secondary station may be the initiator.

The basic format for SDLC is a "frame," shown in Figure 19-1. The information field is not restricted in format or content and can be of any reasonable length (including zero). The maximum length is that which can be expected to arrive at the receiver error-free most of the time, and is hence a function of communication channel error rate.

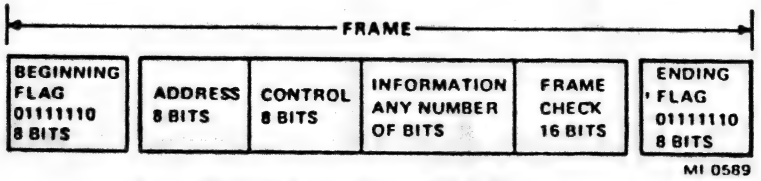

FRAME
BEGINNING FLAG 01111110 8 BITS
ADDRESS 8 BITS
CONTROL 8 BITS
INFORMATION ANY NUMBER OF BITS
FRAME CHECK 16 BITS
ENDING FLAG 01111110 8 BITS
MI 0589

Figure 19-1. Basic SDLC Frame

The two flags which delineate the SDLC frame serve as reference points for the position of the address and control fields and initiate the transmission error checking. The ending flag indicates to the receiving station that the 16 bits just received constitute the Frame Check. The ending frame could be followed by another frame, another flag, or an idle. Note that this means that when two frames follow each other, the intervening flag is simultaneously the ending flag of the first frame and the beginning flag of the next frame. Since the SDLC protocol does not use characters of defined length, but rather works on a bit by bit basis, the 01111110 flag may be recognized at any time.

In order that the flag not be sent accidently, SDLC procedures require that a binary 0 be inserted by the transmitter after any succession of five continuous 1s. The receiver then removes a 0 that follows a received succession of five 1s. Inserted and removed zeros are not included in the transmission error check.

The address field is eight bits long and designates the number of the secondary station to which the command from the primary station is being sent. The control field is an additional eight bits and can have three formats: "information transfer format," "supervisory format," and "nonsequenced format." The only thing in common between the three formats is the P/F (poll/final) bit. A frame with the P(poll) bit set is sent from a primary station to a secondary station to authorize transmission, and a frame with the F(final) bit set is sent by the secondary station in response to the poll. Typically, the primary station will send a number of frames to a particular secondary station, each frame having the P/F bit a 0, until the primary station is finished and ready for the secondary station to respond. At this time the primary station will send a frame having the P/F bit set to 1. The secondary station will recognize that the primary station desires a response and will reply, perhaps with a number of frames, each having the P/F bit a 0. Then, when the secondary station is completing its response to the "poll," it will send a "final" frame which has the P/F bit set to 1.

The three control formats are summarized in Table 19-1.

Table 19-1. SDLC Control Field Formats

Format	Bits				Acronym
Information	Nr	P/F	Ns	0	I
Supervisory	Nr	P/F	00	01	RR
	Nr	P/F	01	01	RNR
	Nr	P/F	10	01	REJ
Nonsequenced	000	P/F	00	11	NSI
	000	F	01	11	RQI
	000	P	01	11	SIM
	100	P	00	11	SNRM
	000	F	11	11	ROL
	010	P	00	11	DISC
	011	F	00	11	NSA
	100	F	01	11	CMDR
	001	I	00	11	ORP

Sent Last

Sent First

The information format is used for ordinary data transmission and is the only one of the three formats that uses frame sequence numbering. Each frame transmitted in this format is numbered so that the receiving station can tell if any are missing; when retransmission is required, the receiving station can tell the transmitting station which frame to start with in the retransmission. A station that transmits sequenced frames counts and numbers each frame. This count is known as Ns. A station receiving sequenced frames counts each error-free sequenced frame that it receives; the receiver count is called Nr. The Nr count advances when a frame is checked and found to be error-free; Nr thus becomes the count of the "next expected" frame and should agree with the next incoming Ns count. Returning to the format shown in Table 19-1, the initial 0 bit indicates that this control field is in information format, the three Ns bits are "this is the message number I am sending," the P/F bit is set if the station is concluding its poll or its response to a poll, and the three Nr bits are "this is the message number I am expecting next."

The supervisory format is used in conjunction with the information format to initiate and control information transfer in the information format. The first two bits sent, 1 and 0, designate that this control field is in supervisory format. The next two bits indicate which command this is: RR, RNR, or REJ. An RR (Receive Ready) can be sent by either a primary or a secondary station, and indicates that all sequenced frames up through Nr-1 have been received correctly, and that the originating station is ready to receive some more. RNR (Receive Not Ready) can also be sent by either a primary or a secondary station, and also acknowledges messages up to Nr-1. Unlike RR, however, RNR indicates a temporary busy condition in which no additional frames that require buffer space can be accepted. REJ (Reject) is a command/response which may be transmitted to request transmission or retransmission. It acknowledges successful receipt of frames up through Nr-1 and requests Nr and following frames.

The nonsequenced format is used for setting operating modes, initializing stations, etc. As the name implies, nonsequenced communications are not sequence checked and do not use the Nr and Ns system. The first two bits sent, 11, indicate a nonsequenced format, the P/F bit has its usual meaning, and the remaining five bits in the control field are used for encoding the various commands and responses.

The commands and responses encoded in the nonsequenced format control field are listed below.

NSI (Nonsequenced Information): This indicates that the information which follows in the variable length information field is being sent separately from any sequenced message presently in progress.

RQI (Request for Initialization): This is transmitted by a secondary station when it wishes the primary station to send an SIM command. If the primary station sends something other than SIM, the secondary station sends another RQI.

SIM (Set Initialization Mode): This command initiates system-specified procedures at the receiving secondary station for the purposes of initializing. Nr and Ns counts are set to 0 at both the primary and secondary stations. The expected response to SIM is NSA.

SNRM (Set Normal Response Mode): This command subordinates the receiving secondary station to the transmitting primary station, and the secondary station is not expected to initiate any transmissions unless requested to do so by the primary station. The Nr and Ns counts at both the primary and the secondary stations are reset to 0. The secondary station remains in this mode until it receives a DISC or SIM. The expected response to SNRM is NSA.

ROL (Request On-Line): This is transmitted by a secondary station to indicate that it is disconnected.

DISC (Disconnect): This command places the secondary station effectively offline. That station cannot receive or transmit information frames and remains disconnected until it receives an SNRM or SIM command. The expected response to DISC is NSA.

NSA (Nonsequenced Acknowledgement): This is the affirmative response to SNRM, DISC, or SIM.

CMDR (Command Reject): This is the response transmitted by a secondary station in normal response mode when it receives a non-valid command. A frame with CMDR in the control field has an information field following which is arranged in a fixed format which reports that station's present Ns, that station's present Nr, and four bits which indicate 1) an invalid or non-implemented command, 2) an information field associated with a command which isn't supposed to have one, 3) an information field that was so long it caused buffer overrun, or 4) the Nr received from the primary station does not make sense, given the Ns that was sent to it.

ORP (Optional Response Poll): This command invites transmission from the addressed secondary stations.

While SDLC is simpler in most aspects than previously discussed protocols, the block check calculations are a good deal more complex. The first difference is that the transmitting station begins with a "remainder value" of all 1s rather than the customary all 0s. The binary value of the transmission is premultiplied by X^{16} and divided by the generating polynomial $X^{16}+X^{12}+X^{5}+1$. The quotient digits are

ignored and the transmitter sends the complement of the resulting remainder value, with the high order bit first.

One other feature which should be discussed is the procedure for prematurely terminating a data link. This is called "abort" and is accomplished by the transmitting station's sending eight consecutive 1 bits. The abort pattern may be followed by a minimum of seven additional 1s to idle the data link, or it may be followed by a flag. The purpose of a flag following an abort is to clear the CRC function at the receiver.

The preceding has been a rather condensed description of SDLC and the reader is advised to read IBM's "IBM Synchronous Data Link Control — General Information" (GA27-3093 File GENL-09) for further information. The reader is also referred to documentation on ADCCP and HDLC for a look at some similar protocols. ☐

Glitch

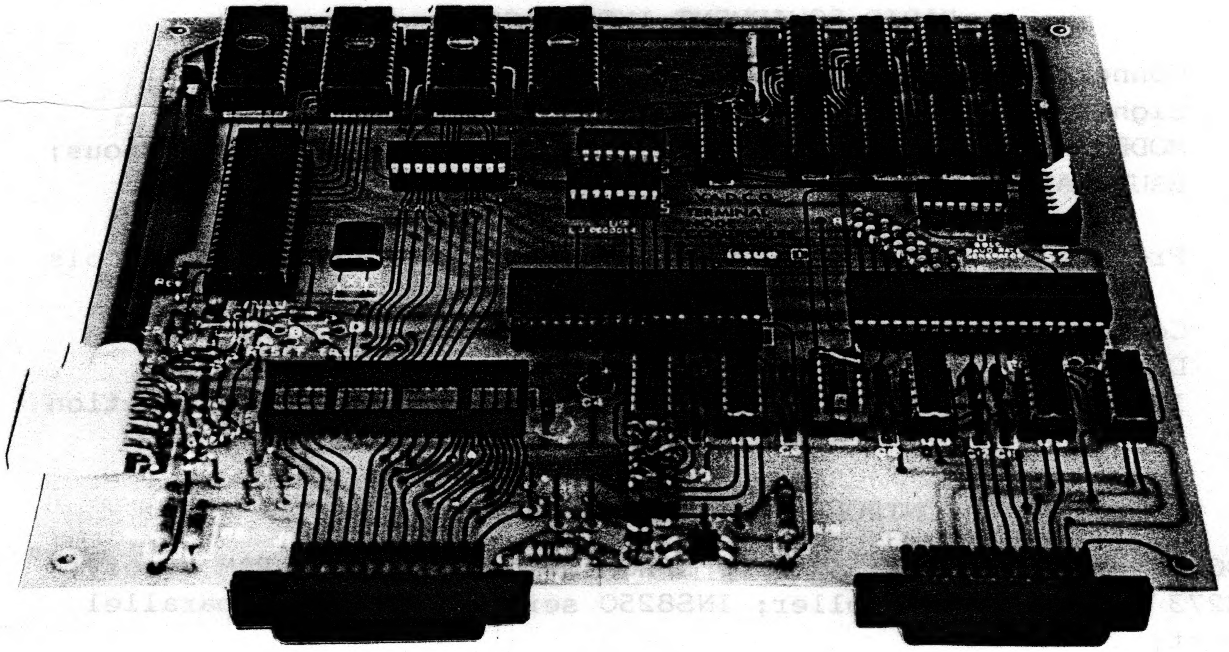
In the Terminal Node Controller assembly notes, page 5, the Baud rates for S1 switch positions are wrong. The table should read:

SWITCH	RATE
1 (Top switch)	38,400 Baud
2	19,200 Baud
3	9600 Baud
4	4800 Baud
5	2400 Baud
6	1200 Baud
7	600 Baud

ASCII INFORMATION ON RADIO

.... ERROR~FREE

Now you too can take advantage of CLEAN data transfer via Amateur Radio Links to drive CRT's, teletypes, printers, or even unforgiving computer systems. The Vancouver Amateur Digital Communications Group (a non-profit group) has developed a stand-alone PACKET RADIO CONTROLLER to link you with a growing network. The bit-oriented protocol and firmware construction assures that it won't become obsolete . Older start-stop methods are losing out to bit-oriented data transfer methods, yet the controller can translate between the old and the new...including ASCII. Don't be left behind in the dust! A quick change of an EPROM will make your controller compatable with network up-grades. You can communicate DIRECTLY station to station or through a sophisticated community packet network STATION NODE. The data device may be serial RS232, current loop, or even parallel at the interface...and you also get programmable bit-rates and code conversion!!! Now you can leave your computer free for more important tasks....



TERMINAL NODE CONTROLLER

Price for the bare board, including all documentation, is $32.00 in Canada, or $30.00 in U.S. funds.
Available from:

VADCG
818 Rondeau St.
Coquitlam, B. C.
V3J5Z3

TERMINAL NODE CONTROLLER SPECIFICATIONS

DIGITAL EQUIPMENT INTERFACE

Connector Type	DB-25-S;
Signal Levels	TTL, EIA RS232, or 20ma. current loop;
Wiring	Standard for EIA cables for DTE equipment and may be patched for DCE equipment;

SERIAL

BAUD Rates	Software selected any speed DC to 56K;
Character Frames	Asynchronous with 5, 6, 7, or 8 bits, Even, Odd, or No-Parity bit generation and detection, 1, 1½, or 2 Stop-bits;
Buffering	Double character string buffering, Prioritized interrupts;
Control Signals	CTS, RTS, DSR, DTR, RI, and DCD; False start bit detection, Line-BREAK generation and detection, software readable interface status;

PARALLEL

Buffering	Double character string buffering;
Signals	Multiple 8-line unidirectional and bi-directional inputs and outputs with programmable interrupt controls;

RADIO EQUIPMENT INTERFACE

Connector Type	DB-25-S;
Signal Levels	TTL or EIA RS232;
MODEMS	Asynchronous or self-clocking Synchronous;
BAUD RATES	600, 1200, 2400, 4800, 9600, 19,200, or 38,400 bits per second
Protocol	Either SDLC or HDLC bit-oriented protocols with full or half duplex;
Control Signals	CTS, RTS, DSR, DTR, DCD, RT, and TT;
Data Type	NRZI or non-NRZI data type;
Interrupts	Both data transfers and status information are under interrupt control;

CONTROLLER ARCHITECTURE

8085 microprocessor; 4K 2708 EPROM memory; 4K 2114 RAM memory; 8273 data-link controller; INS8250 serial port; 8255 parallel port;

POWER SUPPLY (full population)	Off Board	+12 volts @ 300ma. max.
		-12 volts @ 50ma. max.
		+5 volts @ 1.5A. max.(split)
		-5 volts @ 200ma max.
BOARD	7.75" x 8.5" inches, double sided G-10 glass epoxy with plated holes	